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The microstructure and mechanical performance of high strength alloy steel X2M

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Abstract. In this paper, the microstructure, hardness, tensile deformation and fracture behavior of high strength alloy steel X2M is presented anddiscussed. The influence of both composition and processing on microstructure of the as-provided material and resultant influence of microstructure, as a function of orientation, on hardness, tensile properties and final fracture behavior is highlighted. The macroscopic mode and intrinsic microscopic features that result from fracture of the steel specimens machined from the two orientations, longitudinal and transverse is discussed. The intrinsic microscopic mechanisms governing quasi-static deformation and final fracture behavior of this high strength steel are outlined in light of the effects oftest specimen orientation, intrinsic microstructural effects and nature of loading.

Keywords: composition; processing (carburization); orientation; microstructure; hardness; tensile properties and fracture behavior

1. Introduction

In more recent years, important advances in the specific domain of alloy engineering have been successfully used to enhance both strength and fatigue characteristics in advanced aerospace and other related technological innovations and concomitant applications. Concurrently, an increased emphasis and importance related to the industries of aerospace, power generation and even automotive, is pushing this technology to new limits that is largely dictated by both commercial and military interests. This has certainly provided the desired interest and impetus for developing new, improved and advancedmetal alloys as viable replacements and/or alternatives to the materials currentlybeingused. This particular aspect has been shown and neatly described in the published literature by several researchers in recent years (Thomas *et al*. 1965, Pascover and Makas 1965, Van Slycken *et al*. 2006, Van Slycken *et al*. 2007, Danzeisen *et al*. 2008). Both prevailing and emerging technology requirementscontinue to place an increased emphasis on issues like off-the shelf availability, lower weight, damage tolerance, durability, fabricability, high life-cycle

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